Small Business Innovation Research/Small Business Tech Transfer

Tools to Enhance Airspace Safety by Minimizing and Mitigating RF Link Loss, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

Radio frequency (RF) communications provide navigation and communication capabilities that are essential to safe operation of the current and future airspace systems. Loss of C2 and navigation links is a significant hazard even for current generation systems, and future systems that will operate with a high level of automation and autonomy, often without a highly-skilled operator onboard, will be even more susceptible to lost links. NASA has identified "Critical system failure…including loss of C2 link, loss or degraded GPS" as a key safety-critical risk relevant to future aviation systems. The proposed research effort will develop tools to analyze RF link coverage and support decision making that enhances system safety by minimizing the likelihood of lost links. The proposed tools will also enable intelligent responses to lost links that maximize the likelihood links are quickly and safely restored. The approach builds on an existing commercial software tool for RF propagation analysis, adding features to address challenges unique to the operation of future aviation systems, specifically features to enhance the accuracy of RF propagation analysis at low altitudes and to compute time-varying satellite-based-navigation coverage maps. Very low altitude operations play a significant role in future aviation system concepts, including UAS operations such as those envisioned to occur within the UAS Traffic Management framework, and emerging Urban Air Mobility concepts. The proposed research would enhance RF propagation modeling capabilities near and below the tops of obstructions including buildings and vegetation. The work will also build on risk-based path planning tools for UAS currently being developed by the team, integrating RF coverage analysis as an additional consideration in generating minimum-risk paths.

Anticipated Benefits

The proposed technology will directly support the goals of the UAS Integration in the NAS project started by ARMD in 2011, and the UAS Traffic Management (UTM) project begun in 2015. The proposed work will support NASA's emerging interest in Urban Air Mobility to provide a "safe and efficient system for air passenger and cargo transportation within an urban area". The technology will also benefit a variety of other NASA earth science and air vehicle programs that operate UAS.

The initial non-NASA commercial applications of the proposed technology are expected to be to SUAS. The proposed technology will be a key enabler for safely moving to beyond visual line of sight operations (BVLOS) that will provide significant value to a variety of commercial missions including infrastructure inspection missions, precision agriculture, and small package delivery. It will also benefit the military, improving reliability and safety of BVLOS SUAS operations.

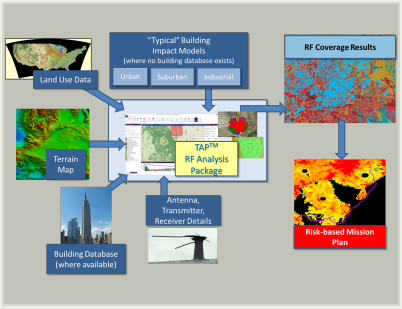

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Table of Contents

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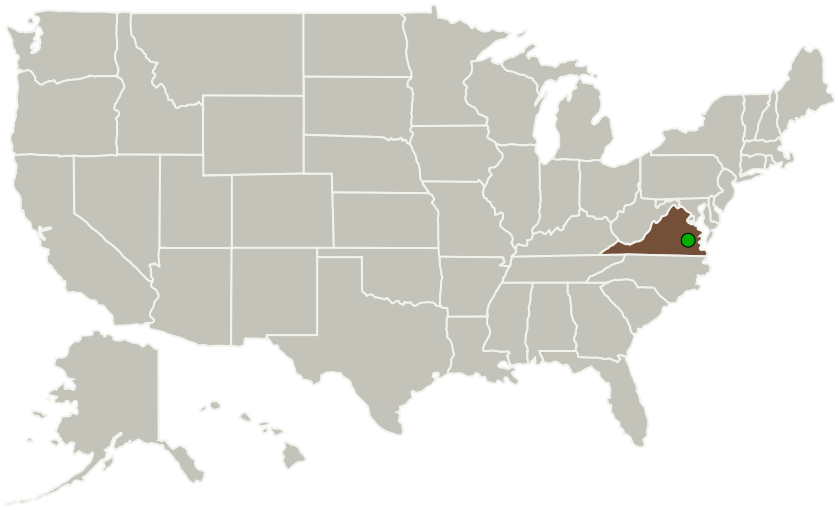
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Barron Associates, Inc.	Lead Organization	Industry	Charlottesville, Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137343)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Barron Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

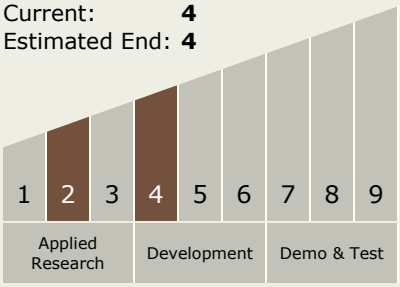
Carlos Torrez

Principal Investigator:

Richard Adams

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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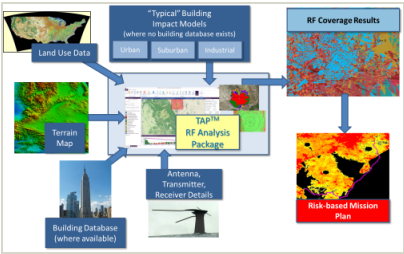
Images



Briefing Chart Image
Tools to Enhance Airspace Safety by Minimizing and Mitigating RF Link Loss, Phase I
(https://techport.nasa.gov/image/127637)

Final Summary Chart Image
Tools to Enhance Airspace Safety by Minimizing and Mitigating RF Link Loss, Phase I
(https://techport.nasa.gov/image/132514)

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.1 Integrated Systems and Ancillary Technologies

Target Destination

Earth